

## How GOSAT has survived in-orbit anomalies and calibrated radiance spectra for 10 years.

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Since 2009 Thermal And Near infrared Sensor for carbon Observation Fourier-Transform Spectrometer (TANSO-FTS) onboard the Greenhouse gases Observing SATellite (GOSAT) TANSO-FTS onboard GOSAT has provided 0.2 cm<sup>-1</sup>-step radiance spectra from solar reflected light in shortwave infrared (SWIR) to thermal infrared (TIR) light using the FTS multiplex-advantage.

The SWIR light passes from the top of the atmosphere to the Earth's surface providing column-averaged dry air mole fractions of carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). TIR light is the thermal emission from the Earth's atmosphere and surface. By combining these wide spectral data, GOSAT can extract the partial column density of lower troposphere, which shows enhanced density from local anthropogenic emission sources.

For SWIR data analysis, we use robust algorithm of differential optical absorption spectroscopy and optical path modification by thin clouds and aerosol can be calibrated by simultaneously observed oxygen (O<sub>2</sub>) data. On the other hand, thermal emission measurements need absolute radiometric calibration. Furthermore, the PC-MCT detector for TIR is less linear than the Si and InGaAs detectors for SWIR.

During the 10-year operation in orbit, TANSO-FTS had system-shut-down in May 2014, May 2018, and November 2018 due to satellite anomalies and cryo-cooler shutdown in August 2018. Every time TANSO-FTS restarted, the thermal condition of the TIR detector and optics had changed and parameters for non-linearity corrections had to be updated. We present how we can calibrate SWIR and TIR spectra for 10 years for decade-long uniform quality.

Keywords: Green House Gases, Fourier Transform Spectrometer, CO<sub>2</sub>, CH<sub>4</sub>, Thermal Infrared, Shortwave Infrared